

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:-

1. A method of purifying impure water contaminated with a filterable impurity and a dissolved impurity, the method comprising the steps of:
providing impure water to a primary microfiltration or ultrafiltration unit to remove the filterable impurity and produce impure filtered water contaminated with a dissolved impurity;
providing the impure filtered water contaminated with a dissolved impurity to a reverse osmosis unit to produce a potable water stream and a residual reverse osmosis stream; and
treating the residual reverse osmosis stream prior to reuse.
2. A method according to claim 1 wherein the residual reverse osmosis stream is treated prior to reuse to backwash the microfiltration or ultrafiltration unit.
3. A method according to claim 1 or claim 2 wherein the residual reverse osmosis stream is treated prior to reuse by being passed through a secondary filter.
4. A method according to claim 3 wherein the secondary filter is a microfiltration or ultrafiltration membrane.
5. A method according to claim 3 wherein the secondary filter is a cartridge filter.
6. A method according to claim 4 or claim 5 wherein the secondary filter is backwashed.
7. A method according to any one of the preceding claims wherein the impure water is sea water.

8. A method according to any one of the preceding claims wherein the insoluble impurities include those typically found in sea water.
9. A method according to any one of the preceding claims wherein the insoluble impurities include organic matter, inorganic matter, particulate matter, biological matter and non-biological matter.
10. A method according to any one of the preceding claims wherein the dissolved impurities include dissolved, soluble or solubilized organic or inorganic matter.
11. A method according to any one of the preceding claims wherein the dissolved impurities include sodium ions and chloride ions.
12. A method according to any one of the preceding claims wherein the residual reverse osmosis stream is treated prior to being reused by one or more of chemical treatment, radiation treatment or physical treatment.
13. A method according to claim 8 wherein the chemical treatment is chlorination, fluorination, disinfection, scale control treatment, water softening, peroxide, sulfite/bisulfite, ozone or mixtures thereof.
14. A method according to claim 8 wherein the radiation treatment is UV, IR, microwave or mixtures thereof.

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15. A method according to claim 8 wherein the physical treatment is ultrasonication or vortexing,
16. A method according to any one of the preceding claims wherein the reverse osmosis stream is treated by heat, electroprecipitation, magnetic treatments or combinations thereof.
17. A method according to any one of the preceding claims wherein the residual reverse osmosis feed is used to backwash the primary microfiltration or ultrafiltration unit and is subject to ultrafiltration or microfiltration by a secondary ultrafiltration or microfiltration unit prior to said backwashing.
18. A method according to any one of the preceding claims wherein the secondary filter comprises multiple stages of filtration.
19. A method according to claim 18 wherein the multiple stages of filtration include a first filtration through a coarse filter prior to filtration through a membrane filter.
20. A method according to claim 19 wherein the reverse osmosis reject is in controllable fluid communication with coarse backwashable filters such as single or multimedia filters, disc filters, diatomaceous earth filters, membrane filters, strainers, or screens.

21. A method of purifying impure water, the method comprising the steps of providing a primary microfiltration unit, a reverse osmosis unit, said reverse osmosis in downstream fluid communication from said primary microfiltration or ultrafiltration unit, and a controllable fluid pathway for directing residual reverse osmosis feed to backwash said microfiltration unit and wherein the residual reverse osmosis feed is further subjected to ultrafiltration or microfiltration by a secondary ultrafiltration or microfiltration unit prior to a step of backwashing the primary ultrafiltration or microfiltration membrane.

22. A method according to any one of the preceding claims wherein the reverse osmosis reject used to backwash the filter has a suspended solids content of less than a predetermined quantity.

23. A method according to any one of the preceding claims wherein the reverse osmosis reject used to backwash the filter has a suspended solids content sufficient to allow it to be returned to the impure water source

24. A method according to claim 22 or 23 wherein the reverse osmosis reject used to backwash the filter has a suspended solids content sufficient to allow it to be returned to the ocean

25. A method according to any one claims 22 to 24 wherein the suspended solids content is controlled by controlling desalination recovery rate.

26. Apparatus for purifying impure water contaminated with a filterable impurity and a dissolved impurity, the apparatus comprising:
a primary microfiltration or ultrafiltration unit to remove the filterable impurity;

a reverse osmosis unit to produce a potable water stream and a residual reverse osmosis stream; said reverse osmosis in downstream fluid communication from said primary microfiltration or ultrafiltration unit;

a controllable fluid pathway to transfer impure filtered water contaminated with a dissolved impurity from the primary microfiltration or ultrafiltration unit to the reverse osmosis unit; and means for treating the residual reverse osmosis stream prior to reuse.

27. Apparatus according to claim 26 wherein the residual reverse osmosis stream is directed by a controllable fluid pathway to backwash the primary microfiltration or ultrafiltration unit.

28. Apparatus according to claim 26 or 27 wherein the residual reverse osmosis stream is directed by a controllable fluid pathway through a secondary microfiltration or ultrafiltration membrane to backwash the primary microfiltration or ultrafiltration unit.

29. Apparatus according to any one of claims 26 to 28 further including one or any combination of ports for the introduction of chemical agents, irradiation means, ultrasonic generators, vortexing devices, heating elements, electroprecipitators and magnets.

30. Apparatus according to any one of claims 26 to 29 wherein the chemical agents are chlorination agents, fluorination agents, ozonation agents, disinfecting agents, scale control treatment agents, water softening agents, peroxide, sulfite/bisulfite.

31. Apparatus according to any one of claims 26 to 30 for purifying impure water contaminated with a filterable impurity and a dissolved impurity, the apparatus comprising: a primary microfiltration or ultrafiltration unit to remove the filterable impurity;

a reverse osmosis unit to produce a potable water stream and a residual reverse osmosis stream; said reverse osmosis unit in downstream fluid communication from said primary microfiltration or ultrafiltration unit;

a controllable fluid pathway to transfer impure filtered water comprising a dissolved impurity from the primary microfiltration or ultrafiltration unit to the reverse osmosis unit; and

a conduit to transfer a residual reverse osmosis stream from the reverse osmosis unit to backwash the primary microfiltration or ultrafiltration unit via a secondary microfiltration or ultrafiltration unit.

32. Apparatus according to any one of claims 26 to 31 wherein the secondary microfiltration or ultrafiltration unit is a backwashable or disposable cartridge microfiltration or ultrafiltration system

33. Apparatus according to any one of claims 26 to 32 wherein the secondary microfiltration or ultrafiltration unit comprises multiple stages of filtration.

34. Apparatus according to claim 33 wherein the multiple stages of filtration include a first filtration through a coarse filter prior to filtration through a membrane filter.

35. Apparatus according to any one of claims 26 to 34 wherein the reverse osmosis reject is in controllable fluid communication with coarse backwashable filters such as single or multimedia filters, disc filters, diatomaceous earth filters, membrane filters, strainers, or screens.